Introduction to Computer Graphics

Section 2 : http://bit.ly/1hvnZlz

Sheet 2 : http://bit.ly/1edg3ET

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Question 1:

Explain why images are better displayed than text on CRT monitors while text is better displayed than images on LCD monitors.?

Answer:

Images are better displayed than text on CRT monitors. By nature, the illumination of the phosphor dots on the CRT monitors change gradually from pixels to the adjacent pixel compared to the somewhat abrupt change on LCD monitors. This causes the gradual changes in color between the image pixels that gives the required smoothness of the picture. The same characteristic make the text appears more better on the LCD monitors since the abrupt changes makes the text clear. This in addition to some other factors like the dependency of the view quality on the viewer angle on LCD and high illumination on CRT monitors

Question 2:

A graphics programmer or designer works with some interfaces or APIs to produces graphics. Two conceptual models could be used to describe the interaction between the programmer/designer and the interface/API: pen-plotter model and the 3D. Explain the difference between the two models. ?

Answer 2:

Pen-plotter conceptual model:

Answer 2:

Pen-plotter conceptual model:

- The programmers (graphics creator) works in 2D to create 2D and 3D graphics using function calls or user interfaces.
- Hence, He works out the required projection, shading, hidden surface removal, etc., to reduce everything to 2D objects

Answer 2:

3D Graphics system conceptual model:

- The programmers (graphics creator) works directly in the domain of his problem to create 2D and 3D graphics using function calls.
- He specifies objects, shading methods, the camera (viewer) specification, and object material specification.
- The Graphics system (library and GPU) does the projection, shading, etc. to produce the image.

Question 3:

The memory in a frame buffer must be fast enough to allow the display to be refreshed at a rate sufficiently high to avoid flicker. A typical workstation display can have a resolution of 1280 x 1024 pixels. If it is refreshed 72 times per second, how fast must the memory be? That is, how much time can we take to read one pixel from memory? What is this time for a 480 x 640 display that operates at 60 Hz but is **interlaced**?

Answer 3:

```
#include <iostream>
using namespace std;

// For a 1280 x 1024 pixels frame refreshed progressively 72 times per second
int main()
{
		long long number_of_Pixels_per_frame = 1280 * 1024;
		long long number_of_frames_per_second = 72 ;
long long number_of_pixels_per_second = number_of_Pixels_per_frame * number_of_frames_per_second ;
		double speed_to_read_one_pixel = 1.0 / number_of_pixels_per_second;
		cout << speed_to_read_one_pixel  * 1000000000<<  "  nano seconds" << endl;
}
```

Output:

10.5964 nanoseconds

Answer 3:

For a 480 x 640 frame that operates at 60 Hz but is **interlaced**
The total number of pixels in one frame is 480 x 640=307200. This number of pixels must be read 30 times per second. Hence, the timer for reading one pixel is given by

```
//////////////////////
#include <iostream>
using namespace std;

// For a 480 x 640 frame that operates at 60 Hz but is interlaced
int main()
{
        long long number_of_Pixels_per_frame = 480 * 640;
        long long number_of_frames_per_second = 30 ;
long long number_of_pixels_per_second = number_of_Pixels_per_frame * number_of_frames_per_second ;
        double speed_to_read_one_pixel = 1.0 / number_of_pixels_per_second;
        cout << speed_to_read_one_pixel  * 1000000000<<  "  nanoseconds" << endl;

}
```

Question 4:

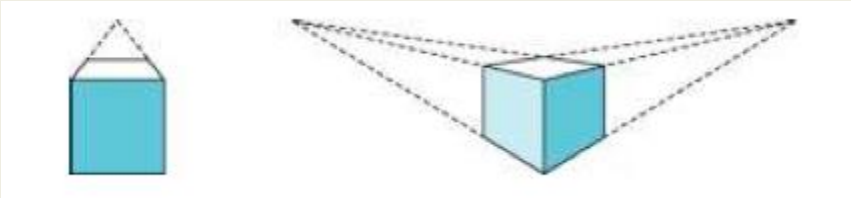
Movies are generally produced on 35-mm film that has a resolution of approximately 2000 x 3000 pixels. What implication does this resolution have for producing animated images for a video show on a computer as compared with film?

Answer 4:

Each frame for a 480 x 640 pixel video display contains only about 300k pixels whereas the 2000 x 3000 pixel movie frame has 6M pixels, or about 20 times as many as the video display. Thus, it can take 20 times as much time to render each frame if there are a lot of pixel-level calculations

Question 5:

Consider the perspective views of the cube shown below. The one on the left is called a one-point perspective because parallel lines in one direction of the cube along the sides of the top converge to a vanishing point in the image. In contrast, the image on the right is a two-point perspective. Characterize the particular relationship between the viewer, or a simple camera, and the cube that determines why one is a two-point perspective and the other is a one-point perspective.



Answer 5:

In a one–point perspective, two faces of the cube is parallel to the projection plane, while in a two–point perspective only the edges of the cube in one direction are parallel to the projection. In the general case of a three–point perspective there are three vanishing points and none of the edges of the cube are parallel to the projection plane

Question 6: Report

To help you understand how rapidly graphics performance has improved is to go to the Web sites of some of the GPU manufacturers, such as NVIDIA and ATI, and look at the specifications for their products. Often the specs for older cards and GPUs are still there. How rapidly has geometric performance improved? What about pixel processing? How has the cost per rendered triangle decreased? **Write down a report the compare between at least two GPUs for the geometric performance point of view.**